

### SUPPORT FOR THE AMENDMENT

This Amendment cancels Claims 7-8; amends Claim 6; and adds new Claims 19-20. Support for the amendments is found in the specification and claims as originally filed. In particular, support for new Claim 19 is found in the specification at least at page 15, lines 7-12 and Figs. 3A-3B. Support for new Claim 20 is found in the specification at least at page 15, lines 14-19. No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 1-6 and 19-20 will be pending in this application. Claim 1 is independent.

### REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of application, as amended, in light of the remarks that follow.

The present invention provides a method of patterning a ferromagnetic layer in which selected portions of the ferromagnetic layer are chemically reacted with a halogen and converted into a nonferromagnetic material. Because the present invention does not require the etching (e.g., ion milling) and chemical mechanical polishing steps that appear in conventional patterning methods, the present invention greatly simplifies processes for patterning ferromagnetic material. Furthermore, because the damage that accompanies ion milling is eliminated, the present invention makes it is possible to improve the magnetic properties of patterned material. Specification page 12, lines 17-21.

Claims 1-4 are rejected under 35 U.S.C. § 102(b) over U.S. Patent No. 5,607,599 ("Ichihara-599"). Claim 5 is rejected under 35 U.S.C. § 103(a) over Ichihara-599 in view of U.S. Patent No. 6,014,296 ("Ichihara-296").

Ichihara-599 discloses a method of processing a magnetic thin film in which a reactive gas containing activated  $\text{BCl}_3$  is used to reactively etch a magnetic thin film.

Ichihara-599 at title; abstract. Ichihara-599 discloses that a "depositing gas", such as  $\text{CH}_2\text{F}_2$ , can be used together with the reactive gas containing activated  $\text{BCl}_3$ , and that active species from the depositing gas are deposited on the sidewalls of the pattern etched in the magnetic film. Ichihara-599 at column 5, lines 52-59. Referring to Ichihara-599's FIGS. 6C and 6D, reproduced below, Ichihara-599 discloses:

Then, the resist 112 is removed by oxygen plasma ashing. Subsequently, the sample consisting of the  $\text{SiO}_2$  film 102, the magnetic thin film 103 and a pattern of the mask material 111 are successively formed on the substrate 101, is placed in an RIE apparatus. Thereafter, infrared rays are converged on the sample to set the temperature at  $200^\circ\text{C}$ . In this condition, the magnetic thin film 103 is processed by supplying a reactive gas containing a depositing gas. In this processing, the **magnetic thin film 103 exposed to ion bombardment is removed by proceedings of thermal reaction, vaporization, and physical etching**. Simultaneously, on the sidewalls of the magnetic of the thin film 103 and the mask material 111, a reaction product of the depositing gas is deposited, thereby forming a first deposited film 104. FIG. 6C shows an intermediate step of etching of the magnetic thin film.

Etching is further allowed to continue for twice as long as the time required for just-etching. The overetched sample is taken out of the RIE apparatus (refer to FIG. 6D). Ichihara-599 at column 15, line 65 to column 16, line 11.

FIG. 6C

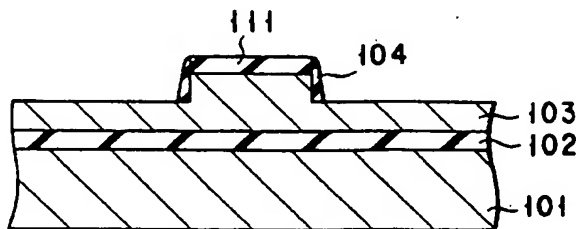
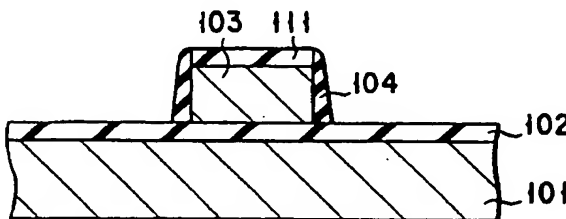


FIG. 6D



However, Ichihara-599 discloses that only the surface of Ichihara-599's magnetic layer is chemically reacted with a halogen (i.e., chlorine)-containing gas. Ichihara-599 fails to suggest chemically reacting with a halogen-containing gas a portion of the ferromagnetic layer underneath the surface of the ferromagnetic layer to make the chemically reacted portion underneath the surface of the ferromagnetic layer nonferromagnetic.

Thus, Ichihara-599 fails to suggest the independent Claim 1 limitations of "exposing an exposed portion of the surface of the ferromagnetic material layer in halogen-containing active reaction gas or reaction liquid, **converting the *exposed portion and a lower layer thereof*** into a compound with a component in the reaction gas or the reaction liquid by chemical reaction; and making the compound nonferromagnetic".

Ichihara-296 fails to remedy the deficiencies of Ichihara-599. The Office Action cites Ichihara-296 against Claim 5 for disclosing forming a servo pattern. Office Action at page 4, line 5.

Because the cited prior art fails to suggest all the limitations of independent Claim 1, the prior art rejections should be withdrawn.

Claims 2-3 are further patentably distinguishable over the cited prior art. As discussed above, Ichihara-599 discloses that a "depositing gas", such as  $\text{CH}_2\text{F}_2$ , can be used together with the reactive gas containing activated  $\text{BCl}_3$ , and that active species from the depositing gas are deposited on the sidewalls of the pattern etched in the magnetic film. However, Ichihara-599 fails to suggest chemically reacting the magnetic film with a fluorine-containing gas to form a fluoride compound of the magnetic film. Thus, the cited prior art fails to suggest the Claim 2 limitation that "the halogen is fluorine" and the Claim 3 limitation that "the compound is cobalt fluoride".

New Claims 19-20 are also further patentably distinguishable over the cited prior art. As discussed above, Ichihara-599 discloses etching a magnetic thin film. However, the cited

prior art fails to suggest the Claim 19 limitation of "producing in the ferromagnetic material layer at least one region where both the surface of the ferromagnetic material layer and an interior portion of the ferromagnetic material layer are nonferromagnetic" and the Claim 20 limitation that "a ratio of a thickness of the nonferromagnetic interior portion of the ferromagnetic material layer to a thickness of the ferromagnetic material layer is in a range of from 0.5 to 1.0".

Claims 6-8 are rejected under 35 U.S.C. § 112, first paragraph. To obviate the rejection, Claims 7-8 are canceled and Claim 6 is amended.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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